

Low temperature isomerizational transformation of gas gasoline on modified zeolite catalysts

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Abstract

New multicomponent catalytic systems synthesized by modifying zeolites (HMOR₁₇ and HZSM-5) and γ -Al₂O₃ with metals (Co, Ni), zirconium dioxide and subsequent sulfation and tungstination of the obtained samples. It was shown that the introduction of zirconia into the M/MOR (where M = Co, Ni) system allows one to lower the isomerization temperature by 140-160°C, turning the medium-temperature skeletal-isomerisation catalyst M/MOR into a low-temperature M/MOR/ZrO₂. It was found that sulfated Co/MOR/ZrO₂/SO₄²⁻ and Co/HZSM-5/ZrO₂/SO₄²⁻ have a higher isomerization activity, which makes it possible to increase the content of isomeric C₅-C₆ components with high octane numbers in gas gasoline from 43 to 66%. It was found that upon contacting the gas gasoline with the Co/MOR/ZrO₂/SO₄²⁻ or Co/HZSM-5/ZrO₂/SO₄²⁻ catalytic systems, efficient processing of higher molecular weight C₇₊ alkanes occurs not only into iso-C₅ and C₆, but also into n-pentane whose content in contact products rises from 19 to 40%. For the first time it was found that at temperatures of 160-200 °C, impurity gaseous C₄₋ alkanes in the gas gasoline are consumed of when contacted with synthesized catalysts, turning into liquid alkanes.

It was established that sulfated catalysts have more isomerizing activity in the low-temperature isomerization conversion of gas gasoline than volframated ones. The effect of the concentration of SO₄²⁻ ions on the activity of the catalysts was studied and it was found that 2 wt.% is satisfactory for the studied catalysts. The temperature dependence of the activity of the most active of the synthesized catalysts in this process – Co/HZSM-5/ZrO₂/SO₄²⁻, was studied. The results showed that the optimum temperature for the isomerization functioning of the selected catalyst is 180 °C. The change in the activity of the optimal catalyst (Co/HZSM-5/ZrO₂/SO₄²⁻) depending on the reaction period was also studied. It was established that with the course of the process, the activity of the catalyst increases and reaches a maximum of 30 minutes work. After this, the activity of the catalyst gradually decreases. In this case, the total concentration of iso-C₅ and iso-C₆ increases by 22.9% and reaches 66.1%, and the conversion of C₇₊ components of gas gasoline is 69.2%.

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